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Also notes by Prof. I. C. White, Asst. Geologist and Professor of Natural History in the University of West Virginia, stating his conclusions respecting the distribution of the members of the Conglomerate in Western Pennsylvania.

Mr. Lesley exhibited an index guage which he had had constructed by Messrs. Young, of Philadelphia, for the use of the Survey, and showed a small topographical model in wax which had been made by means of it.

The Treasurer read the report of the Committee on Finance.

On motion, the appropriations recommended by the Committee were passed.

The report of the Trustees of the Building Fund was read by the Treasurer.

On motion of Mr. Lesley, the Committee on Publication was authorized to issue the articles published in the Transactions, separately, or together, at their discretion.

And the meeting was adjourned.

Notes on the Place of the Sharon Conglomerate in the Palæozoic Series. By Prof. I. C. White.

(Read before the American Philosophical Society, Dec. 17, 1880.)

With regard to the place of this rock in the series, about which there has been much diversity of opinion among geologists, I have to say that my study of it and its associated rocks during the past season in this district,* as well as in Venango and Warren counties, to the east, and in the State of Ohio to the west, has dispelled the idea that I at one time entertained of the possibility of its being the Vespertine Conglomerate, or No. X of Rogers, and has confirmed me in the position that I took in my reports Q and QQ on Beaver and Lawrence counties, viz : that it is the true base of No. XII.

It may be of interest to state here the reasons which caused me to entertain such a possibility.

It happened that during my season's work in Mercer county in '78, I discovered a new limestone in the Mahoning river, only about 50' above the horizon of the Sharon Conglomerate, and nearly 100' below any limestone hitherto known in Western Pennsylvania. It was filled with fossils and some of them seemed to be related to Subcarboniferous types.

* These notes were written for the Report of Progress of the Survey in Erie and Crawford counties. J. P. L.

By a singular fatality, it also happened that the supplemental Report of Prof. Orton on the Hanging Rock district of Southern Ohio came into my hands at about the same time.

It is well known that in the Report in question Prof. Orton takes the ground (in which he was also sustained by the Chief Geologist, Prof. Newberry), that the *Jackson shaft coal* of that State is of *Subcarboniferous age*, since, as he maintained, its place comes below the horizon of the Maxville (Cheater) Limestone of Andrews, and as the *Maxville* was placed in the section about 100' above the *Jackson shaft coal*, I supposed there could be no doubt about it.

I also knew that wherever the Jackson shaft seam was placed, the *Sharon* must go with it, since the general stratigraphy, the flora connected with each, and everything else found in connection with them go to prove that they are identical.

Then the fact that Prof. Orton placed the *Maxville Limestone* the same distance below the *Zoar Limestone* (= our Lower Mercer) that I had found the *new limestone* below our *Lower Mercer*, strengthened the supposition that it might be synchronous at least with the Maxville.

And in order to bring out these new facts, I prepared a special chapter for my Report on Mercer county, QQQ, entitled "The Place of the Sharon Coal in the Rock Series," in which the facts were given that seemed to favor the view that the *Sharon Coal* was of *Subcarboniferous age*, and the Conglomerate below it, *Vespertine*.

Before the volume was published, however, I had studied the matter still farther in the Crawford and Erie district, as well as elsewhere, and as before stated, saw reasons for the giving up the probability of its Subcarboniferous age. I accordingly requested Prof. Lesley to suppress the chapter in question, as its publication at that time would have done more harm than good. Hence QQQ was allowed to leave the press with Chap. VII stricken out. In the meantime Prof. Orton has written me that he will have to give up the position that he took in Vol. III, of the Ohio survey with regard to the *Subcarboniferous age* of the *Jackson shaft coal*, and with that abandoned there remains so little evidence that the *Sharon coal* is *Subcarboniferous*, that for the present it is not worth serious consideration.

The foregoing explanation is relevant in this connection because of the currency given in Prof. Lesley's preface to QQ, to the views expressed in the afterwards discarded Chapter VII, of QQQ.

But while it thus appears that the *Sharon Conglomerate* is the true base of the Carboniferous epoch proper, it must also be remembered that like the *Sharon coal* resting on its top, it seems to have been a deposit peculiar to the *northern rim* of the Coal measures, everywhere skirting them around the north, but seldom passing far south under them, so that although toward the north the succession is definite enough, and it is plainly seen that the *Subcarboniferous rocks* end with the base of this stratum, yet toward the south in the absence of this rock the Subcarboniferous beds, with their fossils, extend

up to the base of the *Sharon coal*, and in the absence of that deposit, also extend to the very base of the *Lower Connoquenessing Sandstone* which then becomes the base of the *Conglomerate series*.

Thus it is that in passing south along the Shenango and Mahoning rivers into Lawrence county, the *Cuyahoga shale*, and its fossils, are found coming up to the base of the Lower Connoquenessing Sandstone.

It follows from this northward distribution of the Sharon Conglomerate, that the marine conditions that had so widely prevailed during the closing period of the Subcarboniferous epoch, so far as Western Pennsylvania is concerned, came to an end sooner around the northern margin of the present coal field than elsewhere, that to the south, marine conditions continued to prevail, while on the northern beaches, brought above or near sea-level either by greater rising or less rapid subsidence, the Sharon Conglomerate commenced to accumulate, and continued to do so during the long time that marine conditions still obtained to the southward; finally however the incursion of the coarse sediments of the *Connoquenessing Sandstone* destroyed the life in the shallow seas southward, and so far as we know this put an end to Subcarboniferous life and conditions in Western Pennsylvania, that had already been forced a considerable distance southward by the incursion of the disturbing currents which carried the coarse material of the Sharon Conglomerate. It may even have happened that still farther south along the Chestnut Ridge region where subsidence was greater, that the marine conditions of the Subcarboniferous epoch continued to exist until the great incursion of coarse sediment which formed the *Homewood Sandstone* and completed the *Conglomerate series*, and this indeed seems in some regions to have actually been the state of affairs since in Fayette and Westmoreland counties, Pa., and in the adjoining county of Monongalia, W. Va., the only member of the series present in any force is the Upper, or *Homewood*, and it is 175'-200' thick. There is nothing at all to represent the *Sharon Conglomerate* of the north, and the interval between the *Umbral Limestone* and the *Homewood Sandstone* is made up of reddish and greenish shales interstratified with green sandstones which look more like *Subcarboniferous rocks* than any representatives of No. XII that I have ever seen. And in fact at times this Homewood Sandstone itself appears absent or in little force, and then the red shales of the *Umbral* continue up to the very base of the *Lower Productive Coal measures*.

Hence, if am correct in this interpretation of facts, it will not do to draw a hard and fast line at any place in the series and say that every thing *above* it is *Carboniferous* and everything below *Subcarboniferous*; for as well as we can unravel the history in Western Pennsylvania, it would seem that the Sharon Conglomerate at least, was in process of formation and synchronous with marine conditions prevailing farther south, essentially similar to what had existed at the north previous to the change in conditions which rendered the accumulation of that mass of coarse sediment possible, and that subsequently the changed conditions at the north were carried farther and farther south with each great incursion of coarse material until

finally the period culminated and ended by the spread of the Homewood Limestone as an almost universal covering over Western Pennsylvania.

After this final catastrophe scarcely any of the life forms that had existed before the accumulation of the Sharon Conglomerate remained, though the process of extinction and change had been progressive toward the south from the beginning.

On this theory only, so far as I can see, can we explain the results at which Mr. Platt of the Survey Corps seems to have arrived from the study of the rocks to the south-east in Jefferson, Indiana and Armstrong counties, viz : that the rocks of No. XI (Subcarboniferous) extend up to the base of the *Homewood Sandstone*, and that it is the only member that can be properly placed in No. XII.

In such localities where Subcarboniferous conditions seem to have existed until the epoch of the Homewood Sandstone, or top member of the Conglomerate series, it would certainly be unwise to include any lower beds in this series, and yet it seems to me equally wrong to draw the line along the base of the *Homewood Sandstone* in such a case and extending it over wide areas, call everything below it Subcarboniferous.

It is a question of time against conditions. If it be right to call all rocks *Subcarboniferous* that were formed everywhere and under any surroundings until Subcarboniferous conditions had closed everywhere then it would undoubtedly be correct to draw the line squarely at the base of the Homewood Sandstone ; but under the broader view that discards cataclysmal changes in the Earth's history, and recognizes the now well proven fact that almost all great changes have been gradual and progressive, and that to be so they must have had a beginning somewhere in the midst of widely differing conditions, recognizing this principle it seems to me there should be no hesitation about extending the line downward from the base of the Homewood Sandstone, as we proceed north, under the feather edges of these northern Conglomerates, until we reach the base of the Sharon Conglomerate, even if this latter stratum were coëtaneous with the deep sea that prevailed along the south line of Western Pennsylvania during the Chester limestone epoch, for all these conglomeratic sandstones, from the base of the Sharon to the top of the Homewood, were formed under similar conditions, and the Subcarboniferous sea at no time returned northward to restore the life forms which the appearance of the Sharon Conglomerate had driven away forever. To do otherwise than this would be equivalent to classifying the marine deposits which are now taking place along the coasts of this country and Europe with the Cretaceous, because perchance Cretaceous life and conditions may now exist in the deep bed of the Atlantic.

I have discussed this matter somewhat at length, hoping to throw some light upon and help to harmonize the hitherto conflicting results of all who have undertaken the study of this question. It is certainly a difficult subject to deal with, but it seems to me that we have now got hold of some of the threads at least, out of which the true history of the fabric can be woven.

Mr. Lesley said, in presenting these notes, that he considered every field geologist entitled to the expression of his opinions, but that only such as worked over the whole field, and knew precisely all the facts in every part of it, would be likely to see a clear way to the final resolution of its difficulties. These difficulties cannot be resolved on the Ohio side of the coal field alone; nor on the Alleghany Mountain side of it alone; nor by even an exhaustive observation in the north, nor by an exhaustive discussion of them in the south. If there *be* "a northern rim" to the ancient coal field, there must have been an eastern and a southern and a western one also; and no generalization will avail that does not satisfy the data all around the compass—and in fine, also, all over the interior area, where unfortunately we have very few opportunities for study.

These difficulties are set forth in the preface to Mr. Platt's report H 5 on Armstrong county, in which the same suggestion of an overlapping of the upper divisions of No. XII is made which Prof. White makes in these notes. But it is there shown that the exhibition of No. XII along the Alleghany mountain, and in Maryland and Virginia, as well as in the northern counties, and in the Anthracite coal region of our own State, is not such as can be entirely explained by the suggestion; which has its value; but which must be cautiously followed as a guide in classification.

The combined labors of half a dozen geologists, all equally competent as observers and theorizers—labors pursued unremittingly now for half a dozen years—have not yet sufficed to procure all the light we need to have thrown on the synchronomy of even our own Pennsylvanian Carboniferous and Devonian deposits; and every fresh survey in a new district like that of Mr. Jones in Maryland, and that of Prof. Stevenson in Southwest Virginia, serves, among other things, to throw doubt upon the shifting generalizations in which too many otherwise judicious geologists are prone to indulge—reversing the directions in which we look for the

original sources and maxima of deposits—shortening the radii of areas of violent variations, and even of nonconformability—and embarrassing the best laid plans for restoring the state of things in ancient days.

Photodynamics. By Pliny Earle Chase, LL.D.

(*Read before the American Philosophical Society, Jan. 7, 1881.*)

The general laws of motion have been largely studied in connection with the special departments of Thermodynamics and Electrodynamics. Little attention has been paid, comparatively speaking, to the much broader field of Photodynamics.

Sir John Herschel showed* that the elastic force of the air, in its resistance to compression, would require to be increased, "*in proportion to the inertia of its molecules*," more than 1,000,000,000,000 fold to admit of the propagation of a wave with the velocity of light, and that this enormous physical force is perpetually exerted at every point, through all the immensity of space. He also said†: "It must be remembered that it is **LIGHT**, and the free communication of it from the remotest region of the universe, which alone can give and does give us the assurance of a uniform and all pervading energy." We have no equally positive evidence of the direct transmission of heat and electricity from the heavenly bodies, and inasmuch as all thermal and electrical phenomena can be explained by local transformations of simple radiant energy, the philosophical basis of Photodynamics appears to be better grounded than that of either Thermodynamics or Electrodynamics.

In 1863, I began a series of general kinetic investigations, in confirmation of views which may be expressed by the following general postulate: *All physical phenomena are due to an Omnipresent Power, acting in ways which may be represented by harmonic or cyclical undulations in an elastic medium.* In my first paper‡ I showed the importance of the fundamental equations $v = \frac{gt}{2}$; $h = \frac{gt^2}{4}$ = the modulus of v ; in which t represents the time of cosmical, molecular, or atomic rotation, and g represents the acceleration of a central force.

By combining these equations with considerations derived from the equality of elastic actions and reactions proportioned to mass, and from tendencies to conservation of areas, I found that the daily and annual fluctuations of the barometer furnish harmonic indications of Sun's mass and distance, and I announced my confident expectation of other astronomical

* Familiar Lectures on Scientific Subjects, pp. 281-3

† Ib. p. 218.

‡ Proc. Am. Phil. Soc., vol. ix, pp. 283-8.